LAW OFFICES
SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
WASHINGTON, DC 20037-3213
TELEPHONE (202) 293-7060
FACSIMILE (202) 293-7860
www.sughrue.com

July 26, 2000

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of Kyoko HIGASHINO and Katsumi ADACHI
STATOR FOR AN AUTOMOTIVE ALTERNATOR
Our Ref. Q60072

Dear Sir:

Attached hereto is the application identified above including 13 pages of specification, claims and Abstract, 7 sheets of formal drawing (Figures 1-11), executed Assignment and PTO 1595 form, executed Declaration/Power of Attorney, an Information Disclosure Statement and PTO form 1449, and the certified priority document.

The Government filing fee is calculated as follows:

Total claims	8	-	20	=		x	$18.00	= $.00
Independent claims	1	-	3	=		x	$78.00	= $.00
Base Fee								$690.00
TOTAL FILING FEE								**$690.00**
Recordation of Assignment								$40.00
TOTAL FEE								**$730.00**

Checks for the statutory filing fee of $690.00 and Assignment recordation fee of $40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from December 27, 1999 based on Japanese Application No. 11-370254. The priority document is enclosed herewith.

Respectfully submitted,
SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
Attorneys for Applicant

By: _____
Robert J. Seas, Jr.
Registration No. 21,092

DESCRIPTION

STATOR FOR AN AUTOMOTIVE ALTERNATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an alternator driven by an internal combustion engine, and in particular, relates to a stator for an automotive alternator mounted in a vehicle such as a passenger car or truck.

2. Description of the Related Art

FIG. 8 is a sectional side elevation of a conventional automotive alternator. FIG. 9 is a front view of a stator core applied to a stator of a conventional automotive alternator. FIG. 10 is a circuit diagram of a conventional automotive alternator. The conventional automotive alternator shown in the figures includes, a case 3 constructed from an aluminum front bracket 1 and rear bracket 2, a shaft 5 with a pulley 4 fixed on one end thereof provided so as to be capable of rotating inside the case 3, a Lundell rotor 6 fixed to the shaft 5, fans 7 fixed on both sides of the rotor 6, a stator 8 fixed to an inner wall of the case 3, a slip-ring 9 fixed on the other end of the shaft 5 for supplying electric current to the rotor 6, a brush 10 for slidingly contacting the slip-ring 9, a brush holder 11 for receiving the brush 10, rectifiers 12 electrically connected to the stator 8 for rectifying an alternating current produced in the stator 8 into a direct current, a heat sink 13 fitted to the brush holder 11, and a regulator 14 attached to the heat sink 13 for adjusting the magnitude of the alternating voltage produced in the stator 8.

The rotor 6 includes a rotor coil 15 for flowing an electric current to generate magnetic flux and a pole core 16 which houses the rotor coil 15 and forms magnetic poles in accordance with magnetic flux. The pole core 16 includes, a pair of alternately meshed first pole core body 17 and second pole core body 18. The first pole core body 17 and second pole core body 18 are made of iron and have claw-shaped magnetic poles 19, 20 at end portions thereof. Gaps are formed between adjacent claw-shaped magnetic poles 19, 20 so that magnetic flux does not leak between the claw-shaped magnetic poles 19,

20, and also serve as cooling passages for cooling the rotor coil 15.

The stator 8 comprises a stator core 22 and two (2) sets of three-phase stator coils 23, i.e. a conductor wound on the stator core 22 at a phase difference of 30 degrees of electrical angle (see FIGS. 9 and 10). The stator core 22 is formed in an annular shape by punching thin steel sheets in a shape with convexo/concave portions at equidistant intervals and then lap winding or laminating the sheets. Slots 25 and teeth 24 extending in axial directions are formed in a inner portion of the stator core 22.

In the case of this example, there is provided the 2 sets of three-phase stator coils 23, there are twelve (12) magnetic poles of the rotor 6, 2 x 3 phases correspond to each pole, and seventy-two (72) slots 25 and teeth 24 are formed. The slots 25 are formed in the annular-shaped stator core 22 at a mechanical angle of 5 degrees (360 degrees/72). At this time, since 72 slots uniformly correspond to the 12 poles, the slots 25 are formed at a uniform interval of 30 degrees of electrical angle. The Y-Y connected two sets of three-phase stator coils 23 is provided at a phase difference of 30 degrees of electrical angle in each slot 25, and is electrically connected to the rectifier 12.

In the automotive alternator constructed in this manner, electric current is supplied from a battery (not shown) through the brushes 10 and the slip ring 9 to the rotor coil 15, generating magnetic flux. The claw-shaped magnetic poles 19 of the first pole core 17 are magnetized as north (N) poles by this magnetic flux, and those (poles 20) of the second pole core are magnetized as south (S) poles thereby. Meanwhile, rotational torque from the engine is transmitted through the belt and the pulley 4 to the shaft 5, rotating the rotor 6. Thus, a rotating magnetic field is applied to the stator winding 23, generating electromotive force therein. This alternating electromotive force passes through the rectifiers 12 and is converted into direct current, the magnitude of the current is adjusted by the regulator 14, and the battery is recharged.

In the above automotive alternator, there are one (1) slots 25 for each (1) set of the stator coils 23, each (1) phase and each (1) magnetic pole. Magnetic field leakage is seldom formed between adjacent claw-shaped magnetic poles 19, 20 of the rotor 6 via teeth 24 and the time over which magnetic flux leaks to the teeth 24 is short. Accordingly, there is a only a small decrease in the effective magnetic field for the stator coils 23 occurring due to magnetic flux leakage, and surges in the magnetic flux is reduced.

Moreover, an automotive alternator similar to the one described above is shown in Japanese Patent Application Laid-open No. 4-26345.

In a conventional automotive alternator constructed as above, since the stator core has 72 slots, which is a lot, there is a problem in that the insertion time and installation characteristics of the stator coils 23 in the stator core 22 are poor.

Also, with the conventional automotive alternator, as shown in FIG. 11 which is an electromagnetic field analysis chart drafted by the present inventors (Slot opening portions (the abscissa) are spaced a uniform interval of 30 degrees of electrical angle, this means that, for example, with a mechanical angle of 24 degrees, 24 degrees and 36 degrees are repeated and the interval is uneven. The ordinate shows ratios of higher harmonic components of magnetomotive force in the stator with respect to a fundamental wave) when the interval of the slot opening portions is an equal 30 degrees fifth (5^{th}) and seventh (7^{th}) harmonics are not present in the magnetic flux density waveform. Nevertheless, eleventh (11^{th}) and thirteenth (13^{th}) higher harmonic components of magnetomotive force in the stator 8 are large, and when 11^{th} or 13^{th} higher harmonic components of magnetomotive force are present in the rotor 6 there are problems in that, surges in magnetic flux cannot be sufficiently suppressed due to interference by the harmonic components and fluctuation in the generated voltage cannot be sufficiently suppressed. Moreover, magnetic attractive force is generated between the claw-shaped magnetic poles 19, 20 of the rotor 6 and the stator 8 and causes the stator 8, case 3 and the like or the claw-shaped magnetic poles 19, 20 of the rotor 6 resonate which generates a sound that is unpleasant for passengers.

SUMMARY OF THE INVENTION

The present invention aims to solve the above problems with the conventional art and an object of the present invention is to provide a stator for an automotive alternator which has good stator coil installation characteristics, which further has a large effect on surges in magnetic flux and the magnetic attractive force between the stator and a rotor, and which can reduce higher harmonic components of magnetomotive force in the stator

According to one aspect of the present invention there is provided a stator for an

automotive alternator wherein,

in an automotive alternator including:

the stator including, a stator core in which a plurality of slots extending in axial directions are formed at an inner circumference thereof and two sets of three-phase stator coils which are fitted into the slots;

a rotor provided inside the stator so as to be capable of rotating, including, a rotor coil for flowing a current to generate magnetic flux, and a pole core for housing the rotor coil and forming a plurality of claw-shaped magnetic poles in accordance with magnetic flux, and,

2 slots are provided for each phase of stator coils and each magnetic pole and the total number of the slots is 72 or more,

the stator core is such that a plurality of sheet-shaped magnetic members with a plurality of teeth patterning the slots at one side of a yoke are laminated, the stator coils are disposed in the slots, and the stator core is rounded such that the stator coils become an inner side thereof and both end surfaces thereof are contacted to connect the stator core in an annular shape.

According to another aspect of the present invention, a mutual interval in the circumferential direction between a center of air gaps of adjacently formed slot opening portions is formed to be uneven.

According to yet another aspect of the present invention, the interval of slot opening portions is a repeated electrical angle of α degrees and (60 - α) degrees, and α degrees is in a range of from 16 to 29 degrees.

According to still yet another aspect of the present invention, the interval of slot opening portions is a repeated electrical angle of α degrees and (60 - α) degrees, and α degrees is in a range of from 22 to 24 degrees.

According to still yet another aspect of the present invention, the interval of slot opening portions is a repeated electrical angle of 24 degrees and 36 degrees.

According to still yet another aspect of the present invention, projections extending in a circumferential direction are formed on tips the teeth which partition the slots, and a mutual interval in the circumferential direction between a center of air gaps of adjacent slot opening portions is varied by projecting lengths of the projections.

According to still yet another aspect of the present invention, widths of the teeth which partition the slots are uneven.

According to still yet another aspect of the present invention, a contact surfaces of the stator core connected as an annular-shape are formed by dividing a wide tooth among the teeth of uneven widths in a circumferential direction with a substantially orthogonal surface.

BREIF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view for explaining a former winding structure of a stator core applied to a stator for a automotive alternator according to the present invention.

FIG. 2 is a process sectional view for explaining a manufacturing process of a stator core.

FIG. 3 is a perspective view for explaining a manufacturing process of a stator core.

FIG. 4 is a front view of a stator core.

FIG. 5 is a partial enlarged view of a stator core.

FIG. 6 is a circuit diagram of the automotive alternator according to the present invention.

FIG. 7 is an enlarged view of an essential portion of a stator core showing another example of the stator for a automotive alternator according to the present invention.

FIG. 8 is a sectional side elevation of a conventional automotive alternator.

FIG. 9 is a front view of stator core applied in the stator of a conventional automotive alternator.

FIG. 10 is a circuit diagram of a conventional automotive alternator.

FIG. 11 is a chart showing higher harmonic components of magnetomotive force in a stator.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiment 1

FIG. 1 is a perspective view for explaining a former winding structure of a stator core applied to the stator for a automotive alternator according to the present invention. FIG. 2 is a process sectional view for explaining the manufacturing process of a stator core. FIG. 3 is a perspective view for explaining the manufacturing process of a stator core. FIG. 4 is a front view of a stator core. FIG. 5 is a partial enlarged view of a stator core. FIG. 6 is a circuit diagram of the automotive alternator according to the present invention.

As shown in FIG. 1, a stator core 122 according to the present invention is formed in a rectangular shape by laminating a predetermined number of sheets of a SPCC material which are sheet-shaped magnetic members punched in a predetermined shape. A total number of seventy-two (72) teeth 124, which is the same as in the related art, are formed at one side of a yoke 123. Trapezoid-shaped slots 125 are formed between adjacent teeth 124.

As is shown in (a) of FIG. 2, insulators 49 are mounted in the slots 125 of the stator core 122, and straight portions of wire-strand groups 35A, 35B are inserted in each slot 125 so as to be stacked. Accordingly, as is shown in (b) of FIG. 2, wire-strand groups 35A, 35B are mounted in the stator core 122. At this time, straight portions 30b of wire-strands 30 are insulated from the stator core 122 by the insulators 49 and are received in the slots 125 so as to line up in a row in a radial direction.

Next, as is shown in FIG. 3, both end surfaces of the stator core 122 are brought together and welded, and thus a cylindrical stator core 122 is obtained, as shown in (c) of FIG. 2 and FIG. 4. By rounding the stator core 122, each slot acquires a rectangular cross-section and opening portions 127 thereof becomes smaller than the width

dimension of the straight portions 30b.

FIG. 5 is a partial enlarged view of a stator core according to the present invention. In the present invention, although the total number of slots 125 is the same as that in a conventional example, 72 slots, and there are 12 rotor magnetic poles, an interval, taken from the center of air gaps of adjacent slot opening portions 127, in a circumferential direction, is uneven. That is, projections 124a extending in a circumferential direction are formed on the tips the teeth 124 which partition the slots 125, and a mutual interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 127 is varied by long and thin projections 124a and short projections 124a.

The mutual interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 127 is formed by repeating 24 degrees and 36 degrees of electrical angle. Hence, as shown in FIG. 6, wound two sets of three phase stator coils have a phase difference of 36 degrees of electrical angle.

By making the interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 127 an uneven, repeated interval of 24 degrees and 36 degrees, as shown in FIG. 11, compared to the conventional example where the electrical angle is 30 degrees, 5^{th} , 7^{th}, 11^{th}, and 13^{th} higher harmonic components of magnetomotive force in the stator 8, which is a magnetic flux density wave form, are lowered with good balance.

Moreover, generally the upper tolerance limit of these higher harmonic components is preferably set at around 13% in order to prevent occurrence of a noise which is unpleasant for passengers. Consequently, if the interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 127 is in the range of from an uneven, repeated interval of 16 degrees and 44 degrees to an uneven, repeated interval of 29 degrees and 31degrees, advantageous effects can be obtained.

Furthermore, if the interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 127 is in the range of from an uneven, repeated interval of 22 degrees and 38 degrees to an uneven, repeated interval of 24 degrees and 36 degrees, the upper tolerance limit of the higher harmonic components may be set at around 8%. That is to say, 5^{th} , 7^{th}, 11^{th}, and 13^{th} higher harmonic components may be

lowered with good balance.

Also, the stator core 122 having a plurality of small thin teeth 124 in a plurality of slots is not (formed as) a conventional one-piece tubular object but is shaped from a laminated rectangular body rectangular into a cylindrical shape via a manufacturing process. Hence, mounting of the stator coils on the stator core is facilitated and the quality of the product may be improved while at the same time lowering the cost.

Moreover, although the stator core 122 according to the present invention is made into a cylindrical shape from a rectangular body, it is not necessarily limited to a rectangular body and as long as the slot opening portions 127 are in an expanded state when mounting the stators coils, the effects can be achieved. For example, similar effects can be achieved by preparing a plurality of circular shapes with a large curvature which are then combined and connected while reducing the radius of curvature.

Embodiment 2

FIG. 7 is an enlarged view of an essential portion of a stator core showing another example of the stator for a automotive alternator according to the present invention. In a stator core 222 according to the present invention, adjacent teeth 224 are formed with uneven widths. Slots 225 have approximately the same widths, and an interval in the circumferential direction between the center of air gaps of adjacent slot opening portions 227 is an uneven, repeated interval of 24 degrees and 36 degrees.

Accordingly, projections 224a extending in a circumferential direction formed in slot opening portions 227 may be formed in the same shape. Consequently, similar effects may be obtained without forming the long and thin projections and short projections provided in Embodiment 1.

Furthermore, in the present embodiment, a wide tooth 224 is divided in a circumferential direction by substantially orthogonal surfaces 224b. These surfaces 224b serve as contact surfaces when connecting a stator core 224 as an annular shape. The stator core 224 of an annular shape is produced by welding these surfaces 224b. Hence, a stator core 222 may be obtained in which the function of the contact surfaces 224b is facilitated, the connecting operation is simplified, and joining properties are thereof are high.

A stator for an automotive alternator according to the present invention is provided wherein,

in an automotive alternator including:

the stator including, a stator core in which a plurality of slots extending in axial directions are formed at an inner circumference thereof and two sets of a three-phase stator coils which are fitted into the slots;

and a rotor provided inside the stator so as to be capable of rotating, including, a rotor coil for flowing a current to generate magnetic flux, and a pole core for housing the rotor coil and forming a plurality of claw-shaped magnetic poles in accordance with magnetic flux, and,

2 slots are provided for each phase of stator coils and each magnetic pole and the total number of the slots is 72 or more,

the stator core is such that a plurality of sheet-shaped magnetic members with a plurality of teeth patterning the slots at one side of a yoke are laminated, the stator coils are disposed in the slots, and the stator core is rounded such that the stator coils become the inner side thereof and both end surfaces thereof are contacted to connect the stator core in an annular shape. Thus, since the stator core is divided when the stator coils are inserted therein, the installation characteristics thereof are improved.

Also, the mutual intervals in the circumferential direction between the center of air gaps of adjacently formed slot opening portions are formed to be uneven. Thus, because the stator core is divided, the mutual intervals can be made with high precision even when they are uneven and the stator core has a low rigidity.

Moreover, the interval of slot opening portions is a repeated electrical angle of α degrees and $(60 - \alpha)$ degrees, and α degrees is in the range of from 16 to 29 degrees. Thus, 5^{th}, 7^{th}, 11^{th}, and 13^{th} higher harmonic components may be lowered with good balance and reliability may be improved.

Also, the interval of slot opening portions is a repeated electrical angle of α degrees and $(60 - \alpha)$ degrees, and α degrees is in the range of from 22 to 24 degrees. Thus, 5^{th}, 7^{th}, 11^{th}, and 13^{th} higher harmonic components may be lowered with further good balance

Further, the interval of slot opening portions is a repeated electrical angle of 24

degrees and 36 degrees. Thus, 5th, and 13th higher harmonic components may be lowered as best as possible and reliability is improved.

Moreover, projections extending in a circumferential direction are formed on tips the teeth which partition the slots, and a mutual interval in the circumferential direction between the center of air gaps of adjacent slot opening portions is varied by projecting lengths of the projections. Thus, the desired structure may be easily achieved without additional components or large design changes.

Also, the widths of the teeth which partition the slots are uneven. Thus, the desired structure may be easily achieved without providing the protrusions of different lengths.

Furthermore, the contact surfaces of the stator core connected as an annular-shape are formed by dividing a wide tooth among the teeth of uneven widths in a circumferential with a substantially orthogonal surface. Thus the contact surfaces may be easily formed even when the teeth are thin due to a large number of slots.

CLAIMS

WHAT IS CLAIMED IS:

1. A stator for an automotive alternator characterized in that,

in an automotive alternator comprising:

said stator comprising, a stator core in which a plurality of slots extending in axial directions are formed at an inner circumference thereof and two sets of three-phase stator coils which are fitted into said slots;

and a rotor provided inside the stator so as to be capable of rotating, comprising, a rotor coil for flowing a current to generate magnetic flux, and a pole core for housing the rotor coil and forming a plurality of claw-shaped magnetic poles in accordance with magnetic flux, and,

2 slots are provided for each phase of said stator coils and each magnetic pole and the total number of the slots is 72 or more,

said stator core is such that a plurality of sheet-shaped magnetic members with a plurality of teeth patterning said slots at one side of a yoke are laminated, said stator coils are disposed in said slots, and said stator core is rounded such that said stator coils become an inner side thereof and both end surfaces thereof are contacted to connect said stator core in an annular shape.

2. A stator for an automotive alternator according to Claim 1 characterized in that,

a mutual interval in the circumferential direction between a center of air gaps of adjacently formed slot opening portions is formed to be uneven.

3. A stator for an automotive alternator according to Claim 2 characterized in that,

said interval of slot opening portions is a repeated electrical angle of α degrees and $(60 - \alpha)$ degrees, and said α degrees is in a range of from 16 to 29 degrees.

4. A stator for an automotive alternator according to Claim 2 characterized in that,

said interval of slot opening portions is a repeated electrical angle of α degrees and (60 - α) degrees, and said α degrees is in a range of from 22 to 24 degrees.

5. A stator for an automotive alternator according to Claim 2 characterized in that, said interval of slot opening portions is a repeated electrical angle of 24 degrees and 36 degrees.

6. A stator for an automotive alternator according to Claims 1 characterized in that, projections extending in a circumferential direction are formed on tips said teeth which partition said slots, and a mutual interval in a circumferential direction between a center of air gaps of adjacent slot opening portions is varied by projecting lengths of said projections.

7. A stator for an automotive alternator according to Claims 1 characterized in that, widths of said teeth which partition said slots are uneven.

8. A stator for an automotive alternator according to Claim 7 characterized in that, contact surfaces of said stator core connected as an annular-shape are formed by dividing a wide tooth among said teeth of uneven widths in a circumferential direction with a substantially orthogonal surface.

ABSTRACT OF THE DISCOSURE

A stator for an automotive alternator is provided with good installation characteristics for stator coils and which can lower noise; the stator 8 including, a stator core 122 in which a plurality of slots 125 are formed at an inner circumference thereof and stator coils 23 which are fitted into the slots, and a rotor 6 provided inside the stator 8 so as to be capable of rotating, including, a rotor coil 15 for flowing a current to generate magnetic flux, and a pole core 16 for housing the rotor coil and forming a plurality of claw-shaped magnetic poles in accordance with magnetic flux, and, 2 slots 125 are provided for each set of stator coils, each phase and each magnetic pole and the total number of slots 125 is seventy-two (72) or more, the stator core 122 is such that a plurality of sheet-shaped magnetic members with a plurality of teeth 124 patterning the slots 125 at one side of a yoke 123 are laminated, the stator coils 23 are disposed in the slots 125, and the stator core 122 is rounded such that the stator coils 23 become the inner side thereof and both end surfaces thereof are contacted to connect the stator core 122 in an annular shape.

FIG. 1

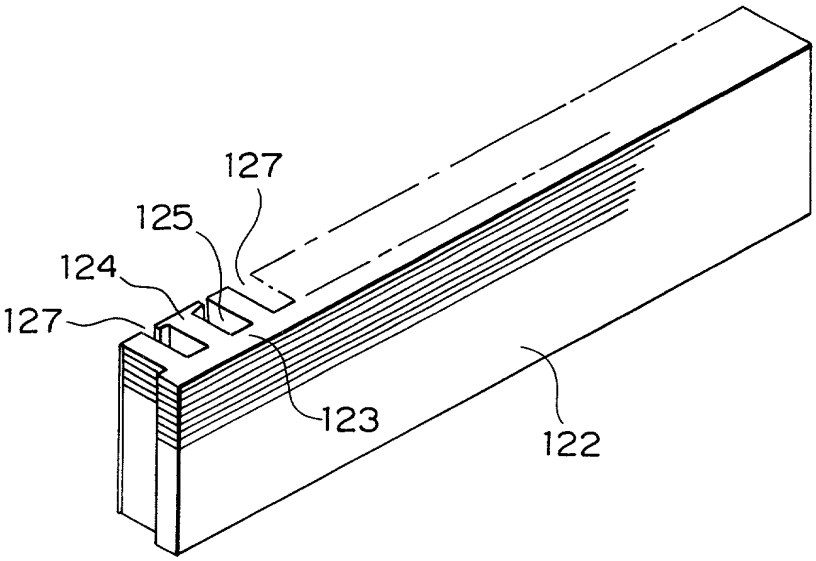


FIG. 2a

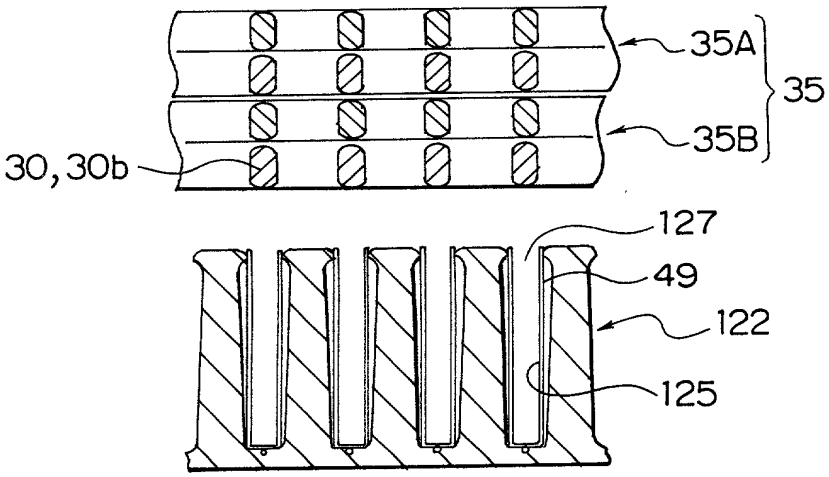


FIG. 2b

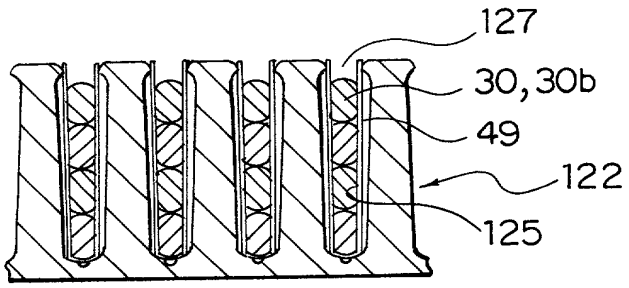


FIG. 2c

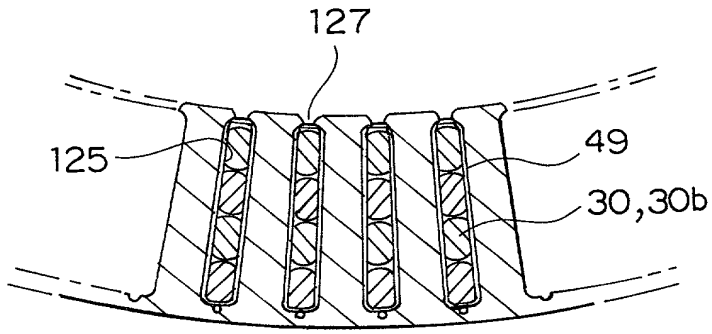


FIG. 3

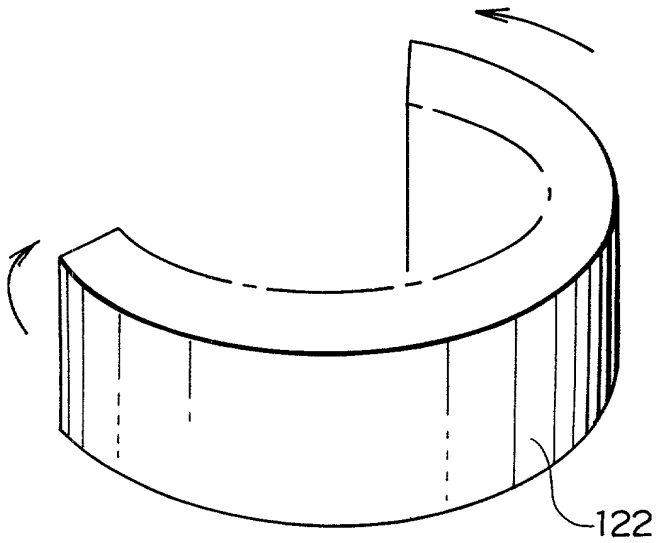


FIG. 4

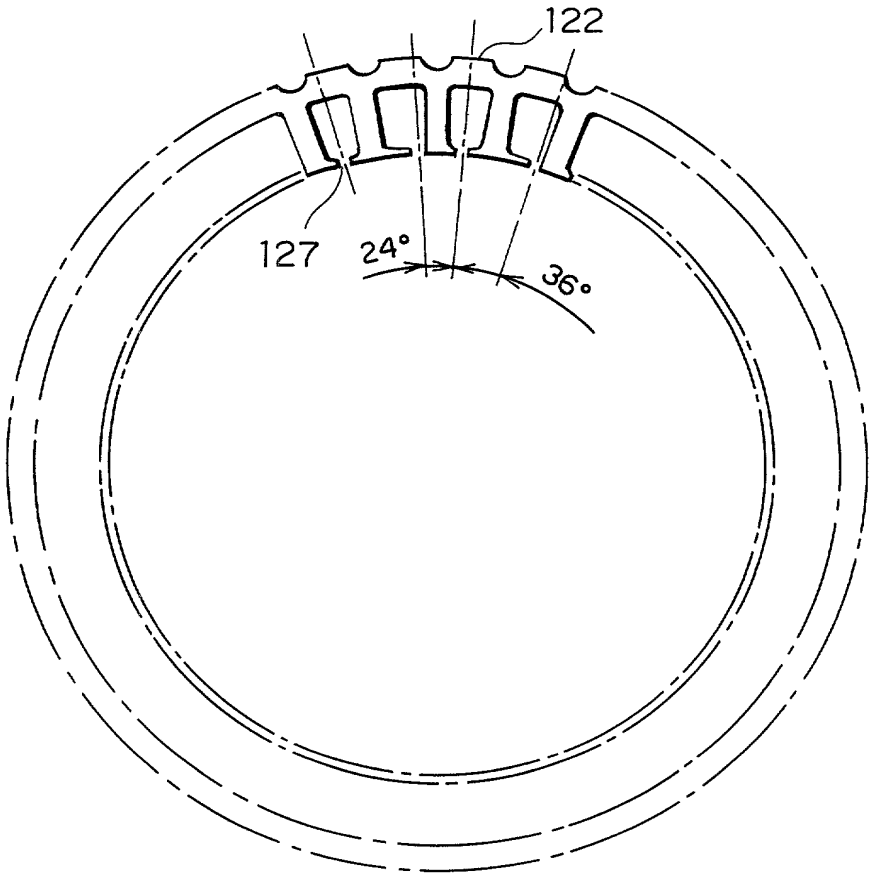


FIG. 5

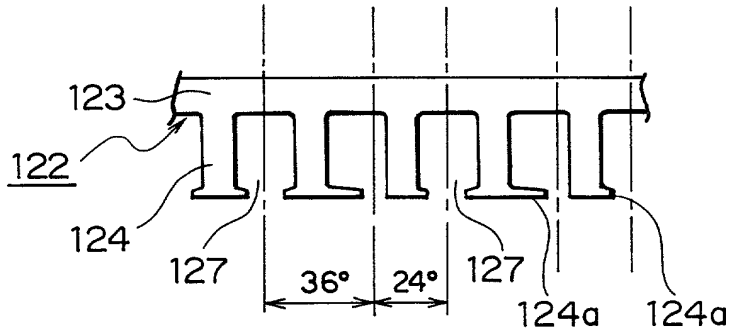


FIG. 6

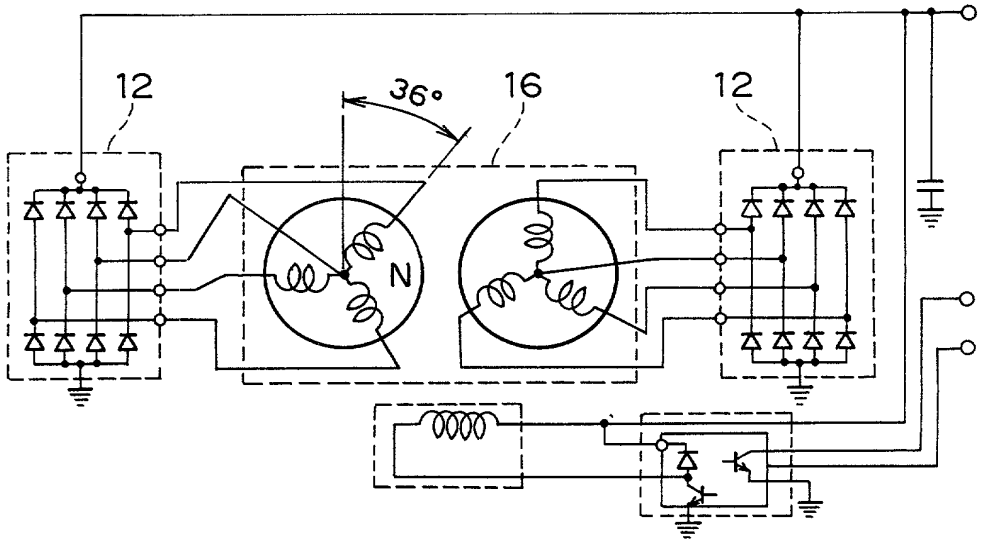


FIG. 7

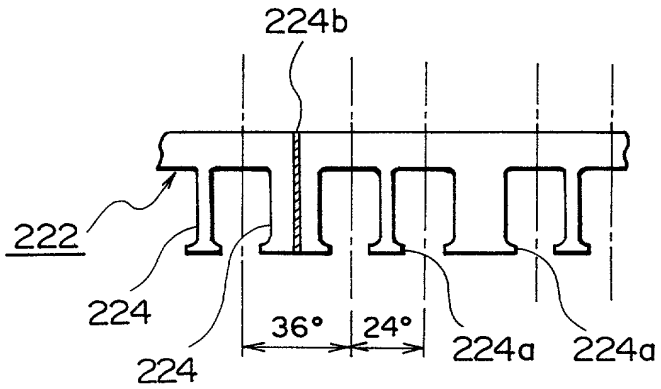


FIG. 8

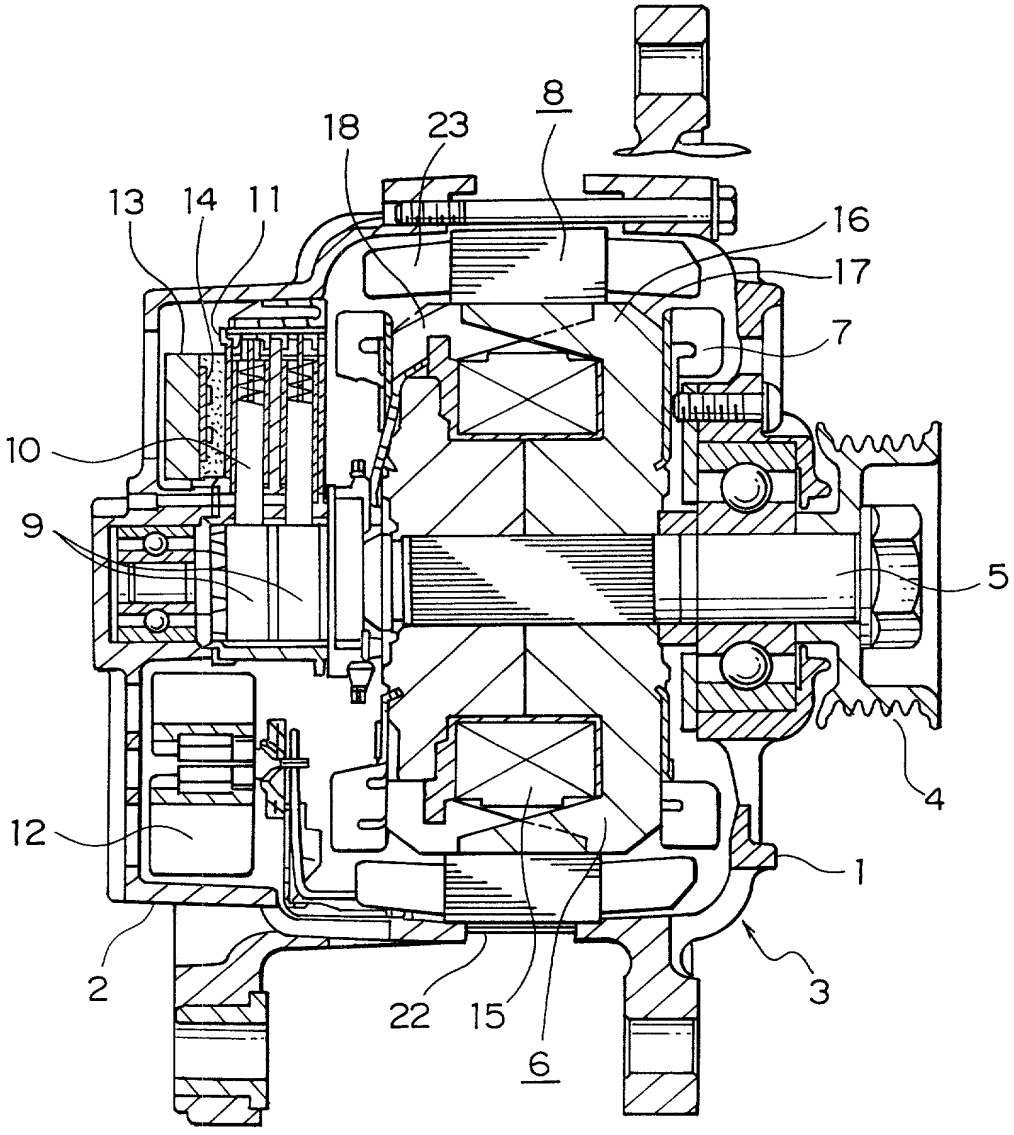


FIG. 9

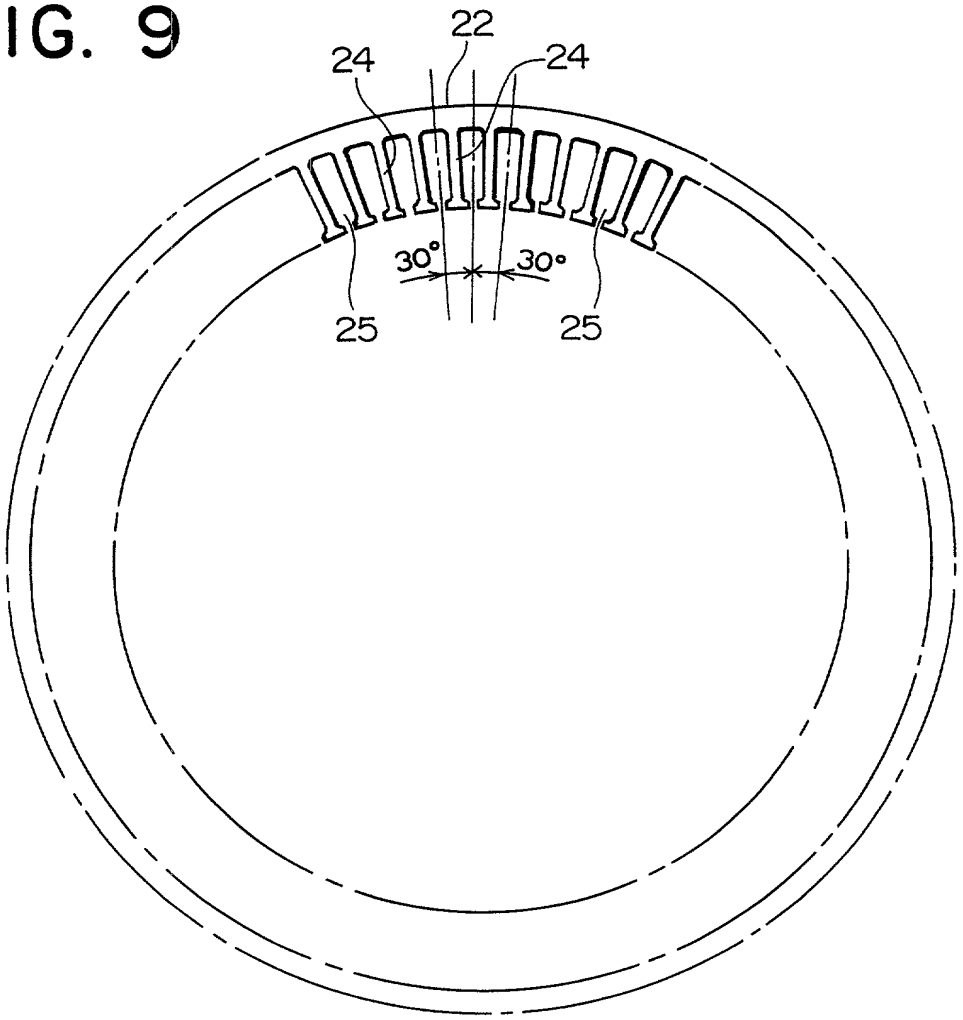


FIG. 10

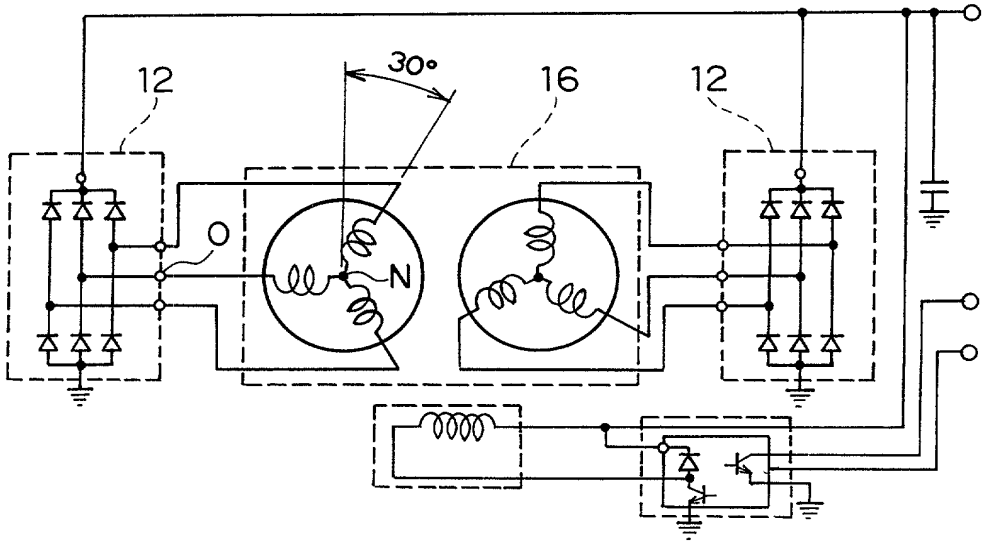
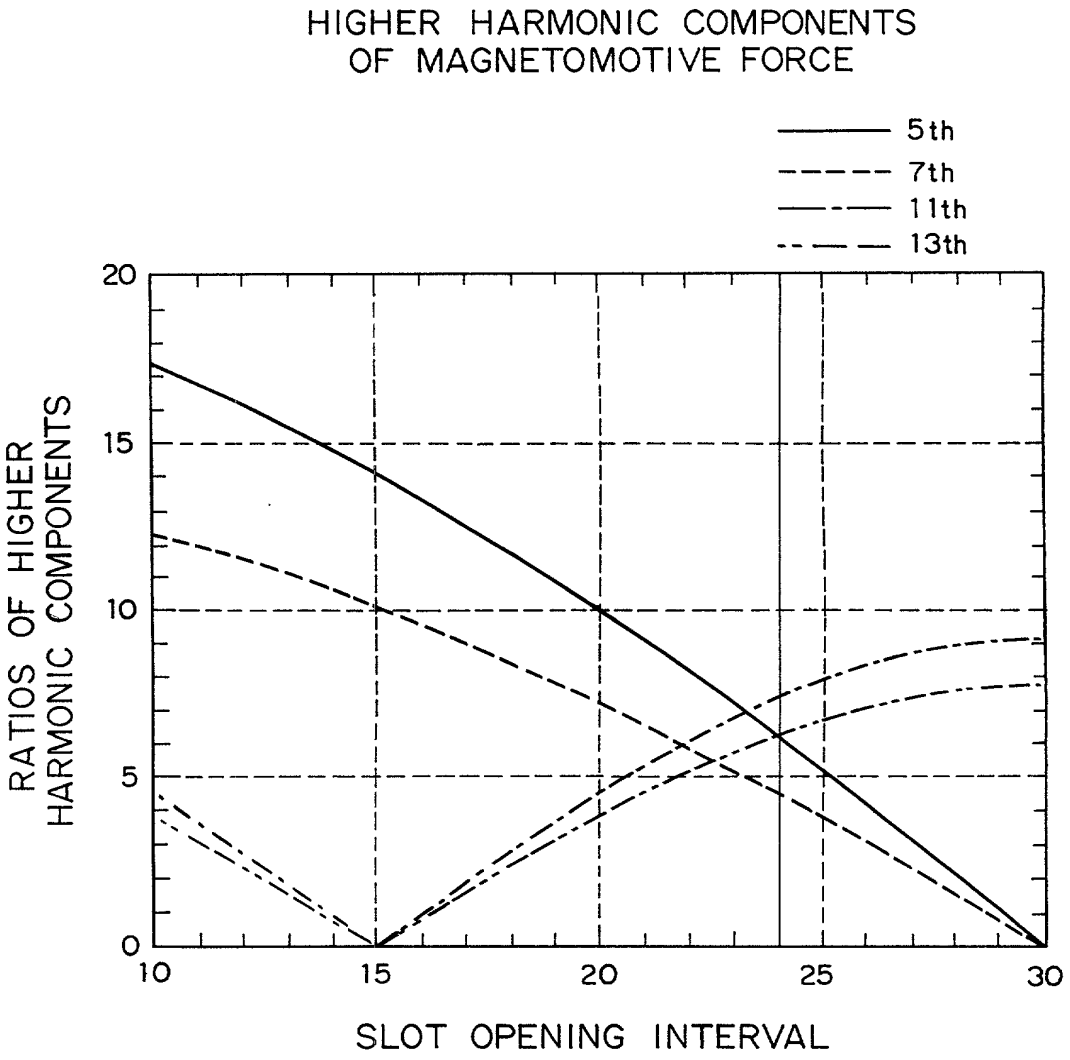


FIG. 11


HIGHER HARMONIC COMPONENTS
OF MAGNETOMOTIVE FORCE
5th
7th
11th
13th
RATIOS OF HIGHER
HARMONIC COMPONENTS
20
15
10
5
0
10
15
20
25
30
SLOT OPENING INTERVAL

Declaration and Power of Attorney For Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者（下記の名称が複数の場合）であると信じています。

_____

_____

_____

上記発明の明細書は、

☐ 本書に添付されています。

☐ ____月____日に提出され、米国出願番号または特許協定条約国際出願番号を_____とし、
（該当する場合）_____に訂正されました。

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

STATOR FOR AN AUTOMOTIVE ALTERNATOR

_____

_____

the specification of which

☒ is attached hereto.

☐ was filed on _____
as United States Application Number or
PCT International Application Number
_____ and was amended on
_____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Japanese Language Declaration
(日本語宣言書)

私は、米国法典第35編119条（a）-（d）項又は365条（b）項に基づき下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約365（a）項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s) 外国での先行出願 (Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	Priority Claimed 優先権主張
11-370254	Japan	27 / 12 / 1999	☒ Yes はい ☐ No いいえ
			☐ Yes はい ☐ No いいえ

私は、第35編米国法典119条（e）項に基づいて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)

私は、下記の米国法典第35編120条に基づいて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約365条（c）に基づく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第35編112条第1項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第37編1条56項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)

私は、私自信の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

委任状： 私は、下記発明者として、以下の代理人をここに選任し、本願の手続きを遂行すること並びにこれに関する一切の行為を特許商標局に対して行うことを委任する。
（代理人氏名及び登録番号を明記のこと）

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*

I hereby appoint John H. Mion, Reg. No. 18,879; Donald E. Zinn, Reg. No. 19,046; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Robert G. McMorrow, Reg. No. 19,093; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; and Brett S. Sylvester, Reg. No. 32,765, my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202.

書類の送付先： Send Correspondence to:

SUGHRUE, MION, ZINN, MACPEAK & SEAS
2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037

直通電話連絡先： （名称及び電話番号） Direct Telephone Calls to: *(name and telephone number)*

(202)293-7060

唯一の又は第一の発明者の氏名	Full name of sole or first inventor Kyoko HIGASHINO
同発明者の署名 日付	Inventor's signature Date Kyoko Higashino May 26, 2000
住所	Residence Tokyo, Japan
国籍	Citizenship Japan
郵便の宛先	Post office address c/o Mitsubishi Denki Kabushiki Kaisha,
	2-3, Marunouchi 2-chome, Chiyoda-ku, TOKYO 100-8310 JAPAN
第二の共同発明者の氏名（該当する場合）	Full name of second joint inventor, if any Katsumi ADACHI
同第二発明者の署名 日付	Second inventor's signature Date Katsumi Adachi May 26 2000
住所	Residence Tokyo, Japan
国籍	Citizenship Japan
郵便の宛先	Post office address c/o Mitsubishi Denki Kabushiki Kaisha,
	2-3, Marunouchi 2-chome, Chiyoda-ku, TOKYO 100-8310 JAPAN

（第三又はそれ以降の共同発明者に対しても同様な情報および署名を提供すること。）

(Supply similar information and signature for third and subsequent joint inventors.)